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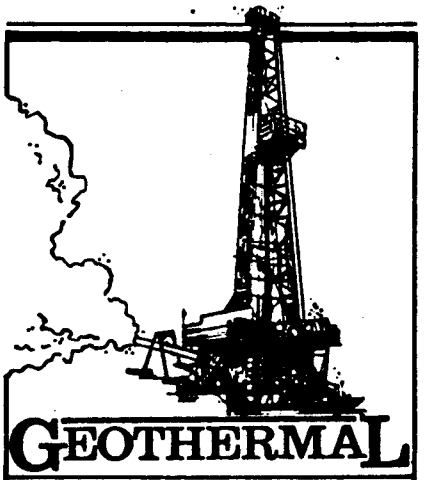
In Imperial Valley, no flap over geo

Editor's note: Geothermal development is an issue of great contention on the Big Island, with the first geo plant scheduled to come on line later this year despite many protests over what opponents say will be negative impacts on the environment. Supporters, meanwhile, challenge such environmental claims and say the alternative energy technology is relatively benign when compared to other power sources.

Last month, at the invitation of the Pro-Geothermal Alliance, the Tribune-Herald's geothermal reporter, Dave Harada-Stone, travelled to Southern California to see several geothermal plants and how they've fit in with their surrounding communities. Besides touring the plants, Harada-Stone also met with local officials to see how the promises made when geothermal development was first proposed have jibed with the reality. The following is the first in a three-part series.



The record in Southern California

By Dave Harada-Stone
Tribune-Herald

EAST MESA, Calif. — To the untrained eye, this parched, barren stretch of California appears to be little more than wasteland, the kind of God-forsaken place where you expect to see cattle carcasses on the roadside and buzzards overhead.

But that's to the untrained eye.

To the biologist, East Mesa is a precious and vital desert habitat, home to the threatened flat-tailed horned lizard and other reptiles, as well as such species as coyotes, rabbits and kangaroo mice.

Criss-crossing that habitat is a network of pipelines leading to six geothermal power plants. The plants, all developed within the past decade, generate 131 megawatts of electrical power, or enough to meet the needs of about 130,000 households.

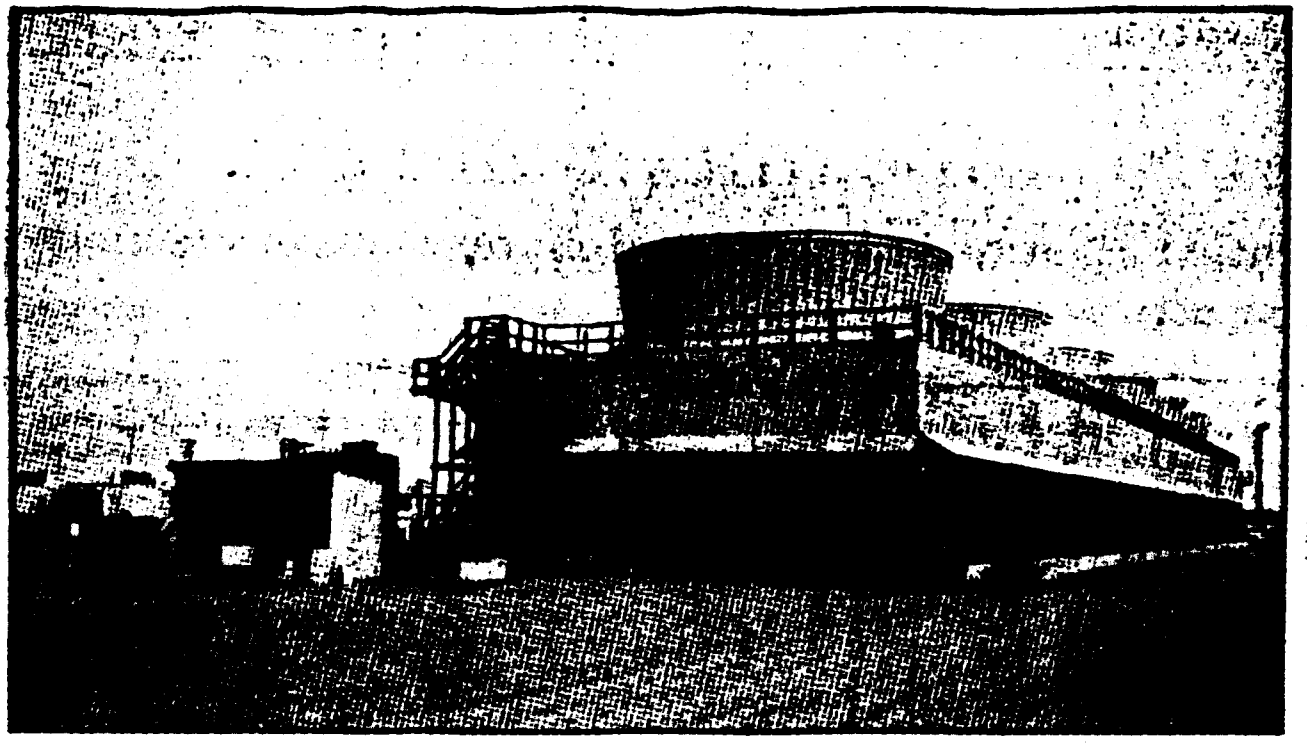
The wells feeding the plants tap into an underground reservoir of brine at depths of 4,000 to 6,000 feet, where the salt-laden water is heated by pockets of magma to temperatures between 290 and 350 degrees Fahrenheit.

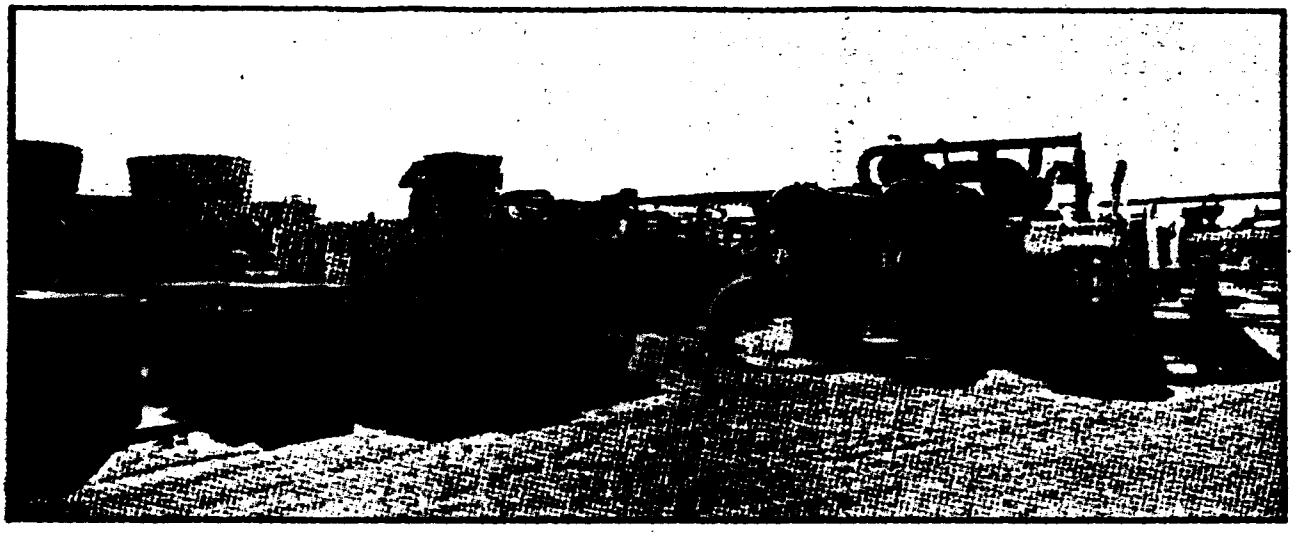
The temperature is relatively low for a geothermal resource, forcing developers to overcome a few thermodynamic hurdles to turn the heat into power.

According to Yona Yahalom, manager for project engineering for the Ormesa geothermal complex developed in the desert by Ormat Energy Systems, the geothermal reservoir beneath the East Mesa was ignored for years by would-be developers eying the Imperial Valley area.

"The resource was considered uneconomical," he explained.

What Ormat did was utilize a





CALIFORNIA STEAMING — Ormat's Ormesa geothermal complex, parts of which are shown above, was built in recent years on environmentally sensitive desert lands in East Mesa under the jurisdiction of the federal Bureau of Land Management. The East Mesa geothermal field is one of three being actively exploited in the Imperial Valley, a vast, arid agricultural area in southeast California bordering Arizona and Mexico.

binary process in which the geothermal resource is used in its liquid state — rather than being flashed to steam as it is in most plants — to heat a working fluid, isopentane, that boils at a relatively low temperature. The vaporized working fluid is then used to turn a turbine attached to a generator.

The process, similar to that to be used in Ormat's planned Puna Geothermal Venture project in Pohoiki on the Big Island, takes place in self-contained units dubbed "Ormat Energy Converters." Prefabricated and assembled in series on the project site, the units are arranged so as to squeeze as much electricity as possible out of the resource, with each batch of converters generating power from lower temperature fluids.

The arrangement allows Ormat to boost its generating efficiency from 12 to 16 percent.

"That doesn't seem like much," Yahalom said, "but those four percentage points actually represent a 25 percent improvement."

Should one of the units fail, the others can continue operating, thus helping Ormat to maintain a reliability factor Yahalom says is more than 99 percent.

Once their thermal energy is spent, the fluids are reinjected into the geothermal reservoir and the isopentane is condensed back into liquid form.

Each of Ormesa's four plants, with a combined output of 54 megawatts, is tied to a control room where technicians monitor

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GEOTHERMAL: In Imperial Valley, plants 'fit in well'

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fluid flow rates, temperatures and other variables represented graphically on computer screens.

The two smaller plants, Ormesa IE and IH, can essentially run themselves, Yahalom said. Plans call for the plants to be left unstaffed at night and on weekends, with technicians at Ormesa I monitoring conditions from their site.

The Ormesa plants, and two neighboring facilities operated by Geothermal Resources International, are on leased federal lands under the jurisdiction of the Bureau of Land Management. The lands have a Class L designation, meaning that access is limited in an effort to minimize human impacts on what is largely a wilderness area.

According to John Whitley of the bureau's El Centro Resource Area office, the plants have proven to be desirable tenants.

"There are no emissions, no discharges and no noise," he said. "They've fit in very well."

While the steady hum of the turbines can be heard during a walking tour of the plants, there is little noise evident at the facilities' boundaries.

Whitley noted that the developers elevated the miles of pipeline carrying geothermal brines from the wells to the plants, a measure he said "cost quite a little bit of money," but ensures uninhibited passage for animals in the area.

The East Mesa field is one of three being actively exploited in California's Imperial Valley, an agricultural region bordering Mexico and Arizona. The others are located on the southeast coast of the Salton Sea, about 35 miles to the northwest of here, and Heber, about 15 miles to the southwest.

Altogether, the 200-plus wells tapping the valley's geothermal resource feed 14 power plants with a combined capacity of more than 400 megawatts.

Geothermal power generation in the valley has made the transition from the drawing board to the field quickly, with most of the development taking place in the past 10 years.

In terms of the number of wells drilled, plants built and money spent, California officials say, the Imperial Valley's geothermal resources have been among the most actively exploited anywhere in the world in the past few years.

Although the valley's geothermal output is but a fraction of the 2,000 or so megawatts of installed capacity at the Geysers geothermal field in Northern California, development in the valley accounted for more than half of all the state's geothermal drilling and construction in the past two years.

Therein lie some important similarities to the proposals pending for large-scale geothermal development in Hawaii. As happened in the valley, developers eyeing Puna's resource hope to go from zero to several hundred megawatts in a few years. And as the valley now does, the Big Island would export most of the power, though through a far more complex transmission system than is used in California, where the power is routed through the Imperial Irrigation District for sale to Southern California Edison.

But unlike efforts to tap Hawaii's geothermal resources, the development in the Imperial Valley has proceeded with a minimum of controversy and protest.

"There's been very little," said Tim Boardman, geothermal district engineer for the California Division of Oil and Gas. "Actually none, zilch."

He noted that most of the valley's geothermal plants are in remote areas, bordering broad stretches of farmland, or, in the case of the East Mesa, desert.

They are also spread through a county of 4,173 square miles — or an area a little larger than the entire Big Island — with a population of 92,000 — about 30,000 less than that of the Big Island.

"This is also a very depressed area of California," Boardman said. "The unemployment rate is more than 20 percent. Any means to bring in jobs is welcome."

And, Boardman says, geother-

mal is relatively clean, at least when compared with coal and oil-fired plants, few of which have been built in California in recent years.

Far from fearing geothermal's impacts, area farmers have a financial stake in the alternate energy technology's success.

"By and large, it's a very symbiotic relationship," said Paul Sweeny, geothermal program manager for the California Regional Water Control Board Board, Region 7.

He noted many of the farmers receive lease payments from the developers for wells drilled on their lands. There have been problems, including spills of hot brine that kills just about anything it touches.

"But they're paid full value for any damaged crops," Sweeny added.

And plant designers have made an effort to get their creations to fit in.

The geothermal plant operated in Heber, Calif. by a subsidiary of ERC Environmental and Energy Services Co. — another subsidiary of which is currently working on a master plan for geothermal development in Hawaii — is one example of that.

Surrounded on all sides by farmland, the 47-megawatt complex was engineered to occupy a minimum of space. The plant and adjacent well field cover less than 40 acres.

All of the production wells, operated by Chevron Geothermal Co. and Unocal Corp.'s Geothermal Division, originate from a central five-acre production island. The wells are drilled at various angles into the center of the geothermal reservoir, where brines at temperatures exceeding 360 F are tapped to fuel the plant.

Started up in 1985, the ERCE plant was the first commercial geothermal facility in Imperial County to receive the necessary permits from county planning officials. The East Mesa plants are subject to federal regulation.

"The farmers love it," said plant general manager Robert Sones of the community's reaction to the facility. "We haven't had any complaints."

The plant produces no odors, and while its equipment generates some noise, it is not noticeable at the project boundary.

Unlike Hawaii's resource, the geothermal fluids beneath the valley are naturally low in hydrogen sulfide, a noxious gas with a rotten-egg-like odor. Recurring hydrogen sulfide releases from Hawaii's experimental HGP-A power plant in Pohoiki made life miserable for many nearby residents, befouling their air and sending some people to the hospital complaining of eye and lung irritations and other symptoms.

Even on a windless day, one cannot smell the gas at the fence lines of most of the Imperial Valley's plants. Its telltale odor is barely perceptible even atop the plants' cooling towers, through which hydrogen sulfide and other non-condensable gases are emitted.

But developers and regulators must still contend with such things as brine spills, sump ponds and solid wastes, the latter including silica taken from the extremely saline brines of the Salton Sea area and laced with trace amounts of toxic chemicals and heavy metals.

The Salton Sea Geothermal Field, located near the southeast shore of California's largest lake, is the most productive field in the Imperial Valley area, boasting six power plants with a combined net output of 193.8 megawatts.

As in the case of East Mesa, the developers of the Salton Sea field had to overcome a few technical obstacles to make development viable.

While the Salton resource is hotter, with an average temperature of 500 F, it is of a much poorer quality, with total dissolved solids in the brine ranging from 200,000 to 300,000 parts per million — or up to 30 percent by volume.

Unchecked, the solids, which are mostly silica, can muck up a power plant's works, clogging pipelines and plugging up the cracks in the earth into which the spent fluids are reinjected.

At the "dual flash" Salton Sea Unit 3 power plant operated by Unocal Corp., brine flows from a wellhead separator into a pressure crystallizer in which steam "flashes" from the hot fluid. The steam leaves through the top of the crystallizer vessel and is routed to a turbine to generate electricity. The brine flows into a low-pressure crystallizer, where a further drop in pressure produces more steam, which flows to the turbine through a separate pipeline.

The brine, reduced to atmospheric pressure, flows by gravity into a clarifier and thickener and then a secondary thickener. Both chambers remove solids that have precipitated from the brine, leaving the remaining fluid clean enough to be reinjected into the underground reservoir without plugging the injection wells.

Some of the solids are recycled to the crystallizers as "seed" material, attracting other solids and thus reducing scaling in the vessels and pipes.

Excess solids are extracted in the form of a filter cake, which in Unocal's case is mixed with other ingredients to form a building material dubbed "geocrete." The material is analyzed for toxic compounds and permeability before being used to pave roads and other surfaces around the plant.

Unocal's Salton Sea plant also boasts the world's largest geothermal well. Vonderahe 1 churns out 2.5 million pounds of geothermal fluid an hour. By way of comparison, engineers expect each of the geothermal wells planned for Ormat's Puna geothermal project to produce 69,000 to 112,000 pounds of steam and fluid an hour.

Tuesday: Protecting the earth from what lies beneath it.